THE PRESENT POSITION OF THE SURGERY OF THE HYPERTROPHIED PROSTATE.[1]

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THE chief interest attaching to the surgery of the prostate gland is in relation to the treatment of obstructive hypertrophy and the associated vesical conditions. Although not exactly in conformity with the title of the subject originally assigned to me by your committee, I have ventured in this paper to make no allusion to other forms of prostatic disease, but have confined myself almost entirely to a statement of the present position of those surgical problems connected with the hypertrophied prostate which are of the most practical importance.

The admirable papers in which Harrison,[2] McGill,[3] Belfield[4] and Moullin[5] have so recently and so thoroughly reviewed this subject, and the history and statistics of the various operative measures which have been employed are familiar to all of you, and are so comprehensive that I must fully acknowledge my indebtedness to them for the basis of this address.[6]

The main points in reference to enlargement of the prostate may be classified as follows:

1. The nature and chief varieties of the prostatic enlarge-

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[1] Read at the meeting of the American Surgical Association, Buffalo, 1893.

[2] Lettsomian Lectures, 1888.

[3] The British Medical Journal, 1889.

[4] The American Journal of the Medical Sciences, 1890.

[5] Harveian Lectures, 1892.

[6] Further acknowledgment should be made to the papers of Watson (ANNALS OF SURGERY, January, 1889), Gouley (Transactions of the Am. Surgical Ass., 1885), Keyes (New York Med. Record, October, 1891), Wishard (Journ. of Cut. and Gen. Urin. Dis., March, 1892), Guterbock (Berl. Sammlung klin. Vortrage, Heft 4, 1888) and Guyon (Annales des Mal. des Org. Gen. Urin.).

ment and their relation to the vesical changes found associated with them.

2. The symptoms in relation to diagnosis and prognosis: (*a*) subjective; (*b*) objective.

3. The indications for (*a*) non-interference; (*b*) medical treatment; (*c*) palliative treatment; (*d*) operative treatment.

4. The choice of operation.

1. *As to the nature of the enlargement,* the views which require mention are as follows: (*a*) The *hypertrophy of the prostate is a part of a general condition peculiar to advancing years, characterized by widespread, degenerative changes, and by the over-production of fibrous tissue; in other words, a disseminated arterial sclerosis or general atheroma, not limited to the vessels of the genito-urinary system, but when occurring in them, producing both the prostatic hypertrophy and the rigid or feeble bladder, with their resulting symptoms.*—Guyon.

In support of this view it is said that general atheroma and hypertropy of the prostate occur at the same period of life, and are commonly found in the same individual.

It would not be difficult, however, to establish a similar claim for the relation to atheroma of other diseases which appear by preference after middle age. I have no doubt, for example, that if carcinoma were investigated with reference to its association with arcus senilis, or with pipe-stem radials, there would be found a considerable proportion of cases in which the conditions co-existed, but no one would think of basing thereon a theory of causation.

If the prostatic disease were atrophic there would be more *a priori* probability of the truth of this view, but that the defective blood supply invariably associated with arterial sclerosis should cause the extensive overgrowth found in the common variety of prostatic hypertrophy is contrary to pathological law. Moreover, while the large majority of prostatics, *as they present themselves to the surgeon*, are men of advanced years, recent investigation shows conclusively that the original changes in the gland occur in many instances in early middle life and long before the appearance of extensive arterial disease. If we accept the assertions of Griffiths,[1] coincided in by Moullin,[2] that the original growth is glandular, and of the nature of a tubular adenoma, and that the fibroid changes which unquestionably occur are secondary degenerations in this glandular overgrowth, we have another argument against the theory of Guyon, Launois and the French school. Connective tissue proliferation may be associated with general atheromatous disease, but glandular hypertrophy must be of extreme rarity.

The not inconsiderable number of cases which are found during middle life and in persons without evidence of atheroma, and the fact that in persons of very advanced age the enlargement scarcely ever begins *de novo*, are additional reasons for asserting that the weight of evidence is strongly against the correctness of the above view.

(*b*) *The primary change takes place in the bladder itself, and the depression of the posterior wall which is said to occur as the bladder sinks into the pelvis with advancing years, precedes prostatic obstruction and is compensated for by the development of a muscular buttress between the orifices of the ureters, tending toward the obliteration of what would otherwise prove to be an inconvenient pouch.*—Harrison.

This view would oblige us to regard the prostate as primarily a urinary organ, exercising its function, in conjunction with the bladder, in the form of a hollow muscle, funnel-shaped, with the apex downward, and giving support to the contents of the bladder. Ellis[3] and Harrison[4] have proposed to call it the prostate muscle, and the former has even suggested the name *orbicularis vel sphincter urethræ* for both the prostate and the prolongation around the membranous urethra. If this theory be correct the majority of cases of hypertrophy of the prostate are compensatory in nature, and are due primarily to the changes in tonicity and in position of the bladder itself, and to the more frequent demands made upon it in adult life to retain for long times considerable quantities of urine. As soon as a little pouching of the trigone takes place residual urine remains, efforts at expulsion give rise to the inter-ureteral bar and later to general prostatic overgrowth.

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[1] Journal of Anat. and Physiology, No. 23.

[2] Loc. supra cit.

[3] Royal Med. Chir. Trans., Vol. XXII.

[4] Lettsomian Lectures, 1888.

Opposed to this are the following facts:

The prostate is neither in its primary significance nor in its essential function a portion of the urinary tract, but is a sexual organ, and has little relation normally to either the expulsion or retention of urine. This is shown conclusively by its embryology and its comparative anatomy and physiology.

While the prostatic urethra arises with the bladder from the allantois, is entirely distinct from the rest of the urinary passages, and remains so in some instances of hermaphroditism in man and invariably in the monotremata, the prostate itself originates, as regards its glandular portion, from the mucous surfaces of the uro-genital sinus, and as regards its stroma from the genital cord surrounding the Wolffian ducts, behind the allantois and quite distinct from the bladder.

The function of the gland appears to be chiefly sexual, the secretion serving to surround and protect the spermatozoa, the muscular portion to secure the discharge of this secretion into the urethra. The gland, like the testicles, remains small until puberty when, like them, it enlarges, and soon attains its full size.

Furthermore, the prostate is well developed in many animals in whom the horizontal posture precludes the idea that it is functionally merely a continuation of the circular fibres of the bladder,[1] and hypertrophy is even said to have been observed in dogs.[2] The most striking argument in this connection rests on the alleged facts, to which I shall recur later, that like other sexual organs in animals the size and the perfection of the structure of the prostate rise and fall with the breeding season; that in geldings and other castrated animals it shrinks and almost disappears until only a small inelastic fibroid mass is left, and that the same is true of eunuchs.[3]

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[1] Ellis, loc. cit.

[2] Bland Sutton, quoted by Harrison, loc. cit.

[3] Griffiths, Journ. of Anat. and Phys., Vols. XXIII–XXIV.

It seems to me that, if true, this effectually disposes of any theory which makes the prostate chiefly or exclusively an accessory organ of micturition.

This latter view is also contradicted by the facts now to be presented in relation to another explanation of prostatic overgrowth.

(*c*) *The growth, or growths, which make up the enlargement in prostatic hypertrophy, are analogous to those fibro-myomata so frequently found in the uterus.*

This, if true, could scarcely be said to be a full explanation of their occurrence, but by allying them to a well-known group of tumors would certainly bring us a step nearer to their comprehension.

The arguments in favor of this view are as follows: (Thompson) The prostatic vesicle is the analogue of the sinus genitalis in the female—the uterine and vaginal cavities; the structure of the prostate and of the uterus is strikingly similar, and would be almost identical if the tubular glands found in the inner walls of the uterus were prolonged into its substance; the histology of the growths themselves is equally similar, differing chiefly in the predominance of the glandular element in the prostatic tumors; the varieties of the growths, from small encapsulated tumors, easily shelled out, or polypoid growths intimately connected with the uterus or prostate up to the enormous growths which far exceed the original bulk of the organ itself, are identical; or there may be in either case a general hypertrophic enlargement affecting the whole organ; lastly, these disturbances occur at about the same time in the sexual life of the two sexes, that is, during the latter half of the reproductive period. This ends sooner in the female than in the male, and accordingly we find the growths appearing in the former at a somewhat earlier age.

The significance of this striking series of analogies long ago suggested by Velpeau and later formulated by Sir Henry Thompson, cannot be ignored, although this view is dismissed in a few words by the most recent essayist upon this subject, Moullin, with the remark that there is no real homology between the uterine and prostatic tumors. He advances practically nothing in support of this statement, with which I cannot agree. On the contrary, after reviewing the above evidence, I believe we are warranted in provisionally accepting this theory and rejecting that which makes prostatic overgrowth a symptom of general atheroma, and that which regards it as a compensatory hypertrophy secondary to the habit of partial retention and to changes in the bladder walls.

The importance of the conclusion lies in its effect upon the prognosis and treatment.

If the condition is merely a part of a general or constitutional state, or if it is secondary to changes in the vesical walls themselves, it is obvious that comparatively little is to be expected from treatment, operative or otherwise. If, on the other hand, it is a local condition, dependent on causes at present unknown, but which may be said to be inherent in the structure or in the functional condition of the gland itself, and if the changes in the bladder walls and the accumulation of residual urine are the result of the precedent prostatic disease, treatment of the latter, if early and judicious, offers much more prospect of success.

The changes in the bladder are occasioned by (1) the mechanical obstructions which the enlarged prostate offers to the ready and complete evacuation of its contents; (2) by the circulatory disturbance incident to pressure on the prostatic veins into which the blood from the vesical veins passes, and (3) to septic infection.

The prostate being limited in front and below by dense fascia grows upward and backward as it hypertrophies, elongating, narrowing, and sometimes markedly deflecting the urethra, and always raising its vesical orifice to a level higher than the base of the bladder. This change of level in itself makes complete evacuation of the bladder difficult, and this vicious effect is greatly accentuated by the urethral obstruction which is more or less complete, not in proportion to the size of the enlargement, but rather in accordance with its position in regard to the urethra. As a result of these changes the bladder is not entirely emptied at each act of micturition, a certain amount of residual urine remaining behind. This may gradually increase as the obstruction becomes more marked, ultimately causing dilatation of the bladder, with atony consequent on partial degeneration of its muscular walls, or, in consequence of the more vigorous bladder contraction required to empty the bladder, the trabeculæ may become enormously hypertrophied, the inner layers forming pronounced ridges. These by their contraction exert a powerful pressure upon the vesical contents which, escaping very slowly, transmit the pressure in all directions and occasion bulgings or sacculations in such weak parts of the bladder walls as are not supported by muscular bands, or by strong investing fasciæ. This hypertrophy and sacculation is further encouraged by the vesical irritability incident to venous congestion at the neck of the bladder which, as the prostatic veins become more obstructed, keeps up a condition of passive hyperæmia and erythism more potent than residual urine alone to occasion the frequently recurring desire to urinate and the muscular spasm of the sphincter at the beginning of the act which calls for such strong and recurring efforts on the part of the detrusor muscles.

Septic infection of a healthy mucous membrane by the pyogenic microbes of acute or chronic cystitis is not possible, even though such bacteria are present in the urine; when, however, the vesical mucous membrane is congested in consequence of obstruction to venous return, and by distention of the viscus and frequently recurring contractions of the detrusor muscles, it offers but slight resistance to the microbic invasion. The pyogenic microbes are generally carried to the bladder by dirty instruments or, if these are rendered sterile, through failure to cleanse the anterior urethra before the instrument is introduced into the bladder. Often cystitis develops independently of the use of instruments, probably as a result of infection conveyed by way of the urethral mucous membrane.

The pathogenic microbes usually found are the bacillus coli communis and the staphylococcus pyogenes aureus. These cause vesical lesion either by direct action, or indirectly through their ptomaines, and acting upon the urea produce ammoniacal decomposition. The ammoniacal urine in its turn acts as a powerful irritant to the bladder walls, but is the effect, not the cause, of the cystitis.

The vesical lesions incident to septic infection, the special involvement of the areas surrounding the orifices of the urethra, the ultimate thickening and contracture in the interstitial forms of the disease, the progressive infection of the ureters and kidneys in cases complicated by partial or complete retention, have been so clearly formulated that they require but passing notice.

The most important change produced in the bladder from the standpoint of the surgeon is its loss of power to evacuate its contents even when the mechanical obstruction is relieved. This may be due to overdistention, to sacculation, or more commonly to crippling of the detrusor muscles as a result of the chronic inflammation. According to Thompson, habitual catheterization alone, continued for two years, is sufficient permanently to destroy the power of the bladder to evacuate its contents. This loss of power is rapid in proportion to the extent of obstruction, the amount of residual urine, and the severity of the chronic cystitis.

Symptoms of Enlarged Prostate.

A. Subjective.—Mechanical impediment to the rapid and free evacuation of the bladder, and the resultant effect on this viscus and ultimately on the general health occasion certain symptoms which, though not pathognomonic of prostatic hypertrophy, are sufficiently conclusive when taken in connection with the history of the case and certain physical signs elicited on direct examination. These subjective symptoms are:

1. *Undue Frequency of Urination, Particularly at Night.*—This symptom is usually attributed to residual urine. In the early stages of the enlargement the moderate amount of residual urine, if normal in quality and if not undergoing ammoniacal fermentation in consequence of intercurrent cystitis, is no more irritating to the bladder, and produces no more urgency and frequency of urination than do the first few ounces of urine secreted after the bladder has been emptied. If a bladder which holds ten ounces comfortably fails to evacuate the last ounce of water, the only effect of this is to reduce the comfortable capacity of the viscus to nine ounces, thus necessitating an increase in the number of urinations not sufficient to be appreciated, and not com-

mensurate with the frequency noted in many cases where the residual urine is small in quantity. That residual urine alone, without the supervention of congestion or inflammation of the vesical mucous membrane, is not sufficient to cause frequent urination is shown by the fact that a healthy man may voluntarily retain in his bladder portions of the urine at each micturition, and yet will suffer no appreciable increase in the diurnal number of micturitions. Moreover, I have seen many cases where, with a notable amount of urine present, the urinations were not unduly frequent. Finally, the fact that the desire to micturate is most distressing at night is not compatible with the theory that this symptom is directly dependent upon residual urine.

The true cause of frequent micturition is undoubtedly a congested or inflammatory condition of the neck of the bladder and the prostatic urethra. Such inflammation would be markedly aggravated by ammoniacal urine; hence, when the residual urine undergoes this change in consequence of cystitis, it becomes an important factor in the causation of frequent urination.

When, on account of increasing obstruction, the residual urine becomes sufficient in quantity nearly to fill the bladder, it will then occasion frequent urination, because the addition of a few ounces to the nearly full viscus is sufficient to produce a bladder tension which reflexly excites the detrusor muscles.

The cause of frequent urination should then be ascribed primarily to a urethro-cystitis, or to congestion, reflexly exciting the desire to urinate; later, to residual urine.

Difficulty in Starting the Stream.—This symptom, which is perhaps even more characteristic than frequent urination, is due not to mechanical obstruction, but to muscular spasm of the external vesical sphincter, which, excited by reflexes from the hyperæsthetic prostatic urethra and neck of the bladder, is not fully under the control of the will. A temporary reflex inhibition of the detrusor muscles may also delay the act of urination.

Feebleness of the Stream.—A full stream dropping almost vertically from the penis, *i.e.*, without the normal parabolic curve, is a classical symptom of enlarged prostate. The loss of the parabolic curve is sufficiently characteristic and common, and is caused at first by mechanical obstruction, later by atony. The passage of a full stream is, in my experience, the rare exception, even in the early stages of prostatic enlargement. The calibre of the stream is nearly always diminished, to some extent proportionately to its loss of projection. Were this not the case, after the stream is once started many of these cases could empty the bladder as rapidly as in health.

Interrupted Micturition.—This symptom, characterized by the partial or complete stoppage of a fairly full stream, the urine either coming in drops or entirely ceasing to flow, followed in a few seconds or minutes by resumption of the free flow, may be caused by movable intra-urethral or intra-vesical projection of the enlarged prostate, which is so influenced by the flow of urine that it obstructs the outlet from the bladder, but when the stream is stopped again leaves the urethra partly patulous. More commonly it is due to spasmodic contraction of the external vesical sphincter and the compressor urethræ muscles, reflexly excited by urethro-cystitis. After the bladder changes are fairly well advanced, it may be caused by intermittent contraction of the detrusor muscles, always a sign of atony.

The physiology of micturition requires continuous contraction of the detrusor muscles and relaxation of the sphincter *for a brief interval* only. When there is sufficient obstruction to triple or quadruple the time normally required fully to empty the bladder, the detrusor muscles, exhausted by their effort, may relax, whereupon the sphincter muscles, relieved of the *vis a tergo*, promptly contract. After some seconds or minutes the detrusors recover sufficiently to make further efforts at evacuation.

Incontinence of Urine.—This may always be taken as a symptom of retention with overflow, the intra-vesical tension of the overfull bladder being sufficient to overcome the resistance offered by the tonic contraction of the sphincter muscle plus that due to the prostatic enlargement. Incontinence said to be due to "a peculiar form of hypertrophy of the prostate, in which the enlarged third lobe projects wedge-like between the lateral lobes, keeping the neck of the bladder continuously patulous,"[1] is probably as rare as the mechanical improbability of such a symptom from the lesion described would lead one to infer. The statement is based upon the assertion of Mercier,[1] who describes four cases in which the autopsies disclosed this condition, but Thompson (*loc. cit.*), was unable to find any museum specimens which corroborate this statement.

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[1] Ashhurst's Principles and Practice of Surgery, p. 1015, 1889.

Complete Retention of Urine.—Attacks of complete retention are due to an aggravation of the chronic urethro-cystitis accompanied by inflammatory swelling, sufficient when the prostatic enlargement has markedly encroached on the urethral calibre to produce a complete obliteration of the remaining narrow passage. The temporary nature of the retention, and the prompt way in which it usually yields to antiphlogistic treatment, show that the added obstruction is congestive in its nature. It may occasionally, when occurring for the first time, mark the completion of the atrophic process which has finally destroyed all power of contraction in the bladder—more commonly this is preceded by several attacks of retention, with intervals of feeble expulsive power.

Changes in the Urine.—In the early stage of prostatic hypertrophy polyuria, slight albuminuria, oxaluria, in fact all the urinary changes characteristic of sexual neurasthenia, are not uncommon. These changes are to be attributed to the reflexes excited by the chronically congested prostatic urethra upon the kidneys or the general system. In spite of marked obstruction and the presence of several ounces of residual urine this fluid may remain perfectly normal for years. When, however, the passive congestion at the base of the bladder is converted by infection into a cystitis the residual urine undergoes ammoniacal fermentation, becomes at times indescribably foul, is loaded with pus, and presents the varied abnormal conditions characteristic of retention and cystitis.

Sensory Disturbances.—A sense of urgency on urination, discomfort after the act, dull pains in the perineum, rectum, small of the back, hypogastrium, and along the inner surfaces of the thighs, sometimes passing down to the calf of the leg or sole of the foot, are symptoms dependent upon a congested or inflamed condition of the prostatic urethra, and are not directly due to prostatic enlargement. During the intercurrent acute attacks of inflammation these symptoms are greatly increased in severity.

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[1] Recherches Anat. Path., Paris, 1841.

A sense of perineal fulness, aggravated by pressure in this region, a feeling as though the rectum were stuffed, are the only sensory symptoms directly excited by the enlargement.

Constitutional Disturbance.—Even in the early stages of prostatic enlargement, but not before frequent urination and loss of force show that the bladder is experiencing the effects of obstruction, there is often a failure in general health, occasional feverishness, with dry, coated tongue, and loss of mental vigor.

This condition Belfield attributes to early uræmia, and it may certainly be taken as a sign that the kidneys are beginning to feel the effect of the increased intra-vesical tension.

Such a failure of health *antedating* bladder symptoms must be regarded merely as a coincidence, since prostatic enlargement in itself has no effect on the general health. In the late stages of prostatic hypertrophy the patient exhibits the characteristic symptoms of septicæmia and kidney involvement, and perishes from suppression of urine or septicæmia.

It will be seen from the brief resumé of symptoms just given that the only subjective symptoms excited by prostatic hypertrophy are those due to *obstruction* of the prostatic urethra, and the inflammatory and atrophic, and degenerative changes in the urethra, bladder and kidneys resulting from this obstruction.

OBJECTIVE SYMPTOMS OF PROSTATIC HYPERTROPHY.

(1) *Residual Urine.*—Is usually considered as characteristic of prostatic hypertrophy. Fenwick has shown, however, that this symptom may be elicited in any form of obstruction, notably in strictures. It is probably due in these cases to tiring of the detrusor muscle before the bladder is completely emptied.

(2) *Digital Examination by the Rectum.*—This shows any

enlargement which has grown downward and backward toward the rectum, and since the hypertrophy is frequently general, or at least involves the greater part of the gland, the finding of a distinct tumor through the rectum strongly suggests prostatic hypertrophy as a cause of obstructive symptoms. Still, this examination gives absolutely no information as to encroachments on the urethral calibre.

(3) *Instrumental Examination.*—In addition to the presence or absence of residual urine, already mentioned, instruments will enable us to ascertain (*a*) The seat and sometimes the nature of the obstruction, (*b*) The tonicity of the bladder, (*c*) Sometimes the condition of the ureters, and inferentially of the kidney pelves.

The Seat and Nature of the Obstruction can best be determined by introducing solid steel instruments, or silver, or soft English catheters. If these instruments are arrested at a point more than seven inches from the meatus the obstruction is in the prostatic urethra. If an instrument with a prostatic curve is arrested at the same point, but on continued pressure passes on into the bladder often with a distinct jump; and if a Mercier "elbowed" catheter goes in without difficulty the obstruction is probably one caused by upward projection of the urethral floor, and its distance from the meatus can be measured by the solid sounds. If the moderately stiff Mercier catheter will not pass, but a very small gum catheter, or one of the rat-tail pattern enters, the urethra is probably deflected to one side or the other. If all instruments enter readily, but the outward flow of urine is markedly interfered with, the obstruction is of the valvular type.

The cystoscope sometimes shows plainly the intra-vesical projections of the enlarged prostate, and the urethroscope may demonstrate the seat and the anterior surface of an intra-urethral obstruction.

The Tonicity of the Bladder is measured by estimating the force with which the urine is propelled through the catheter. The manometer experimented with by Moullin proved useless.

Examination by means of the finger in the rectum, and a solid instrument passed into the urethra, may throw some light upon the real extent or nature of the enlargement.

The condition of the ureters and pelves of the kidneys may exceptionally be shown by cystoscopic examination. This is often impossible in these cases, but when practicable the openings of the ureters can be seen, and the periodicity and vigor with which they eject the urine, and at times it may even be possible to pass an instrument into the ureters by means of the catheterizing urethroscope, and by an examination of the urine drawn determine how much damage had been done to the kidney and its pelvis.

Instrumental examination will also determine the severity of the urethrovesical inflammation, and the amount of muscular spasm of the sphincters.

The Length of the Urethra is determined by passing a catheter till the urine begins to flow. The position of the meatus urinarius is marked on the shaft of the instrument by the thumb nail, and the instrument is withdrawn, and measurement taken from the thumb nail to the eye. In general hypertrophy there is always an increase in length, and this increase is a rough index as to the extent the vesical outlet is raised above the level of the floor of the bladder. Aside from this, it affords no gauge as to the amount of obstruction.

Diagnosis.—Symptoms of obstruction to the free passage of the urine, associated with symptoms of cystitis, when occurring in a man over forty years of age, are generally due to enlarged prostate. If on physical examination there is no obstruction within seven inches of the meatus, if rectal examination shows that the prostate is enlarged, if the urethra is markedly *lengthened*, if soft or coudé instruments pass when Thompson's sounds are arrested, and if there is residual urine, the diagnosis is rendered nearly positive.

Cystitis with atony, vesical calculus, and urethral stricture cannot be confounded with enlarged prostate after careful examination, though all of these conditions may be coexistent; indeed, the first two are very commonly associated with prostatic hypertrophy.

Cancer and tuberculous prostatitis may at first exactly simulate prostatic hypertrophy, but pursue an essentially different course.

The *classification* of cases of hypertrophy of the prostate may be made from various standpoints. The following factors are, however, most worthy of mention as having a direct bearing upon treatment. They should be taken into account in deciding upon the management of any particular case.

(1) *The Predominant Character of the Growth;* whether *soft*, indicating excess of glandular and muscular elements; or *hard*, showing advanced fibroid change. The distinction can be made more simply and accurately by rectal palpation than by any other method.

(2) *The Seat of the Growth.*—From a practical standpoint this is of chief interest in relation to the changes in the bladder. In a general way it may be said that when the enlargement affects chiefly the lateral lobes, the urethra is narrowed and compressed, and the condition is analogous to that existing in organic urethral stricture. The difficulty in urination depends on causes purely obstructive and quite outside of the bladder itself. That organ undergoes, therefore, the usual hypertrophy and thickening of its muscular walls with diminution of the size of its cavity. There is little or no residual urine.

If, however, the growth is median, and projects backward into and beneath the neck of the bladder, or if the lateral lobes are elongated in the same direction, a dam is formed, behind which urine accumulates. The muscular tissue at the base of the bladder, unable to contract properly, atrophies, and thins; the post-prostatic pouch forms and increases. Generally, vesical atony supervenes and often the expulsive power is completely lost, so that in neglected cases the only urine which escapes from the bladder is the "overflow."

These two conditions may be best differentiated during catheterism. In the former, when there is uncomplicated lateral enlargement and vesical hypertrophy, the catheter goes in possibly with difficulty, but without the necessity for great depression of the handle; it does not go to an unusual depth before reaching urine; there is little or no residual urine. In the other variety the presence of the median obstruction is recognized by the difficulty, often the impossibility, of passing an ordinary instrument, the necessity for employing one of larger curve, or with longer shaft, or of using a Mercier or other catheter coudé. There is always some residual urine; often many ounces.

(3) A third and not unimportant classification may be made on the basis of the *presence or absence of general sclerosis.* If this condition is a factor in the case, rigid vessels, arcus senilis, polyuria, hyaline casts, etc., will be associated with the evidence of vesical inability due to rigidity of the bladder walls. The prostatic enlargement will usually be dense and distinctly fibroid.

(4) *Infection of the vesical mucosa,* with pyogenic organisms, is too important to be ignored, and should be mentioned as modifying materially any grouping of prostatic cases. Indeed, it is almost of itself a sufficient basis for classification, and, if we were compelled to rely upon one single factor, might be said with some show of justice to take precedence of all others.

While the above classification cannot be regarded as exhaustive, and while it must be admitted that as to each of the first three groups cases will be found which it will be difficult to place, I believe that on the whole it will prove a distinct help in deciding upon questions of treatment.

These may be considered in the order already indicated.

(1) *In what Cases is a Purely Expectant Treatment Proper?*—Only in those in which enlargement has produced no symptoms, and catheterism is easy and shows no residual urine.

Such cases would include chiefly those in which the prostatic condition is recognized during a rectal examination instituted for other purposes. They are not infrequent in my practice. They often occur in comparatively young men. An antecedent history of posterior urethritis should, of course, suggest a chronic prostatitis which may be recognized and treated by the usual not very satisfactory methods.

(2) *Is there any Medical Treatment which is Worthy of Trial?*—So far as I know ergot is the only drug which offers any pros-

pect of usefulness, and it must be admitted, first, that it is indicated in only a small proportion of cases, and next, that it is far from demonstrated that it has any distinct effect even then. It was used many years ago on account of the apparent homology between the prostate and the uterus. The recorded results are conflicting, but on the whole decidedly opposed to the theory that it has any specific influence.

I have for years been in the habit of giving it in those cases in which the softness of the prostate seemed to indicate predominance of muscular elements, but have constantly combined it with the bromides, boric acid, belladonna, etc., and with instrumental or other treatment, so that I am unable to draw any definite conclusions, and must confine myself to the statement that in many such instances I have noted enough improvement to make me feel disinclined to discard it. While the medicinal treatment of the prostatic hypertrophy itself is thus unsatisfactory, some of the complications may undoubtedly be benefited by the administration of drugs, notably cystitis, which will always improve markedly under the use of boric acid or salol in conjunction with belladonna and the bromides. The subject is, however, beside the main purpose of this paper, and may be dismissed with the remark that on the one hand much harm is often done by the general practitioner who, with his usual remarkable faith in drugs will frequently in these cases neglect more efficient treatment, while on the other hand the surgeon too often ignores the urinary antiseptics, which are certainly of value in many cases.

(3) *When Should Palliative Treatment be Employed?*—Palliative treatment consists (*a*) in the systematic use of steel sounds or other instruments for purposes of dilatation; or (*b*) in the employment of the catheter, and is of the greatest value in a very large number of cases.

The indications for its employment are as follows:

(*a*) *Dilatation.*—A patient who presents the symptoms of the prostato-vesical congestion of the early stages of hypertrophy, who is disturbed once or twice at night, who has an enlargement of moderate density, appreciable through the rectum, but not offering much resistance to the introduction of an ordinary catheter, and who has but little residual urine, is likely to derive great benefit from the systematic introduction of full-sized steel sounds. I have always under observation a number of such patients in whom this treatment and this alone seems to relieve existing symptoms and to prevent or, at least, delay the development of further trouble. That it can have any true curative effect is unlikely; that it can even modify to any extent the continuous enlargement of the gland seems improbable, but that, either by producing a local atrophy in the parts immediately surrounding the urethra, or by simply stretching the canal itself and relieving local congestion and tumefaction, it mitigates the early symptoms, lessens the vesical irritability, diminishes the amount of residual urine and modifies favorably the whole course of the case, seems to me beyond all doubt, and I base my opinion upon a fairly large experience extending now over nearly twenty years.

Harrison[1] revived professional interest in the method in 1882 by his publications on the subject, recommending specially-shaped instruments with a bulbous enlargement a short distance from the tip. In carrying it out I prefer to introduce about every fifth day the largest steel sound which the membranous urethra will permit to pass, and of allowing it to remain in place for ten to fifteen minutes, or longer if the patient is in bed. Careful sterilization of the instrument and gentleness in its introduction render the treatment absolutely free from objection, and intelligent patients carry it on for themselves for years.

The psychrophor, cold rectal douche, etc., while sometimes of great use in chronic inflammatory conditions of the prostate, have seemed to me to have no effect whatever upon cases of hypertrophy.

(*b*) *Catheterism* should be systematically employed in cases in which the quantity of residual urine is three or four ounces or more, and in which the introduction of the instrument is easy and painless, and the urine is sterile. The frequency should be proportionate to the amount and character of the residual urine, a very good working rule (if the urine is sterile) being to use the catheter once daily (preferably at bedtime) for three ounces, twice for six ounces, and then once more for any additional two ounces. With sterile urine it is rarely necessary to use it oftener than once in every four hours.

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[1] Brit. Med. Journ.

The objections to habitual catheterism in prostatics are (1) the risk of vesical infection; (2) the production of vesical atony. These are very real and very serious, although not sufficient to contraindicate the employment of the method. The first may often, but not always, be avoided by scrupulous and unflagging care as to asepsis. The second is unavoidable, and this fact should be regarded as weighing in favor of operation in all cases where it comes up for consideration.

In the selection of a catheter the softest and smallest that will answer the purpose are usually preferred. This is often absolutely necessary in nervous patients who shrink from the least pain, and who dread the procedure and avoid it as long as possible. It is also proper in unintelligent and clumsy persons, who cannot be taught the use of a solid instrument.

In all others in whom a silver catheter will pass without exciting bleeding or undue pain, it should be the instrument of choice, and should be left *in situ* for a few minutes on each introduction, the point being withdrawn just enough to avoid contact with the wall of the empty bladder.

The largest size that the canal will admit should be used. By this means a certain amount of dilatation is kept up, and I am led by my experience to believe that the progress of the case is favorably influenced. In patients who have faithfully carried it out it has seemed to me that the obstructive condition remained in *statu quo* longer, and was on the whole less pronounced, than the average cases employing the soft instruments.

In those patients who do not present themselves until the introduction of a metallic instrument has become impossible, the choice of catheter lies between the Mercier and the Nélaton, either of which may be used in accordance with the comfort of the patient.

When cystitis is present, its treatment should be conducted on the usual lines, urinary asepsis being the object aimed at.

In those cases of vesical atony in which the obstructive element is not pronounced, or has been removed by operative procedure, electricity might be expected, on *a priori* grounds, to be of much benefit. It doubtless would be if the accompanying conditions were similar to those existing in a case of atrophy of a muscle or a group of muscles of an extremity, but unfortunately the electrode cannot be applied with the same ease or certainty; the additional instrumentation is often objectionable. It is not uncommon to find the application of a current sufficient in power to be therapeutically active, followed by vesical irritation; the intervals necessitated by such intolerance are often so long as to render the treatment futile, and, altogether, at least in my hands, the method has been unsatisfactory.

In those cases in which atony is the predominant condition it should always be tried, but will, I believe, give good results in a very small proportion.

Strychnia has a certain value in these same cases, and should be administered in full doses.

(4) *In what Cases should some Operative Procedure be Recommended?*—It may be said at once that in those patients with but moderate obstruction, or with a high grade of compensatory hypertrophy of the bladder, with a small amount of residual urine, which remains sterile, and in whom catheterism is easy and painless, operation is not to be thought of.

The time may come when by perfecting our methods of diagnosis, and our operative technique, this class of prostatics may be benefited by active surgical interference, but it has not yet arrived. Dilatation and catheterism, as above described, at present represent the best therapeutics, and if the rigid observance of details of antisepsis is emphasized, insisted upon, and never lost sight of, will in a fair proportion of instances see the patient comfortably through his life.

But it must be said with equal positiveness that in the great majority of cases it is at the termination of this stage, when the approaching " break down " in catheter life first begins to manifest itself, when instrumentation becomes more difficult, more painful, or more frequent, when the urine shows fermentive change, and the vesical congestion merges into a true cystitis, that the most valuable time is lost to both patient and surgeon. It is just then that on the one hand operation is for the first time clearly indicated and justified, and on the other that it promises most.

Unfortunately, the great majority of prostatics are not led to consider operation until long after this period, when we have unimpaired general health with pronounced local symptoms, has passed. They are brought to us as a rule only when vesical and renal infection is pronounced, and when the characteristic toxæmia,—a combination often of sapremia, septicæmia, and chronic uræmia—has supervened, and is of itself threatening life. Operation may then be forced upon us, but of course with far less prospect of success.

Its full capability of usefulness can never be determined until it has become customary with the general practitioner to refer such cases to the surgeon at an earlier period, and until the latter has unreservedly recognized the possibility of good which operation then affords.

I have no hesitation, however, in saying that in the absence of evidence of advanced and threatening renal disease of an infective character, but few prostatics, no matter how marked their local symptoms, should at the present day be denied the chance of relief afforded by operation. In this statement I would include not only the cases with pronounced vesical sepsis, but also those with atony; with more or less complete retention; with general sclerosis, rigid vessels, polyuria, and hyaline casts; with even the toxæmia above alluded to. The evidence already presented to the profession seems to me to warrant this opinion, in spite of the unfavorable views as to operative interference formed and expressed by such excellent and experienced observers as Socin, Guyon, and Sir Henry Thompson.

The *mortality* in all forms of prostatectomy has varied from 13.6 (perineal) to 25 per cent. (supra-pubic); while perineal prostatotomy has a mortality of but 4.5 per cent. In considering these figures it must be remembered that many of the cases presented all the unfavorable symptoms which have been mentioned, and that few cases have as yet submitted to operation at an early date. The wretchedness of the life which awaits such patients certainly renders operative risk justifiable. In a collection of thirty-three supra-pubic prostatectomies, in which there were seven deaths, all the patients but four were over sixty; eight were over seventy; almost all were in wretched health, many, as stated by one operator, were "obviously within a few days or weeks of death unless speedily relieved;" another says: "the cases were not selected, except that all mild cases were refused operation, and no desperate case was denied the chance, and of these several were nearly dead when taken in hand."

Moullin's table shows nineteen deaths in ninety-five cases of supra-pubic prostatectomy, a mortality of about 20 per cent.; but the last half of the table (which is arranged chronologically) shows only 15 per cent. This is in accord with the history of nearly every important operation now performed by surgeons. With increased experience comes better judgment in the selection of cases, and greater facility in operative technique.

It is evident that we have not yet the data for estimating the true mortality of operation in those cases in which the more serious contra-indications are absent, but it is certain that it would be much less than has as yet been attained. It is also certain that the possibility of serious disease of the urinary tract above the bladder increases in every case in a direct ratio with the duration of obstructive disease anterior to that organ. Indeed, we know that even frequency of micturition is of itself a competent cause of urethral dilatation, hydronephrosis, etc.; and when to these factors are added the grave vesical changes which follow infection and retention, it seems strange that renal disease is ever absent in patients with long-standing prostatic enlargement.

(4) *The Choice of Operation.*—I may briefly mention, for the sake of completeness, those methods which, in my opinion, are at present to be rejected, either on account of lack of evidence of favorable results, or because the recorded testimony of competent observers is distinctly unfavorable. They include interstitial

injection of iodine, ergotin, carbolic acid, sclerotic acid and other substances (Heine); the application of a continuous current through the negative pole inserted into the body of the gland through the rectum, the positive pole being applied to the abdomen (Bidert, Casper, Roux); the application of the galvano-cautery to the mucous membrane of the prostatic urethra by means of instantaneous flashes (Newman); the division of the bar at the neck of the bladder by means of a cutting instrument inserted through the penile urethra (Mercier, Gouley); a similar section at the neck of the bladder by means of the electro-cautery (Bottini).

I do not mean to say that there is no possibility of usefulness in these plans. It may even be that some of them contain the germs of what is destined to be the approved and successful treatment of the future. At present, however, the evidence points in the contrary direction.

This leaves for consideration the following methods, which will be mentioned in the order of their gravity, as estimated by their probable risk, or by their mortality as determined by existing statistics.

(1) *Over-stretching of the Prostatic Urethra.*—This procedure is not likely to be followed by good results in cases in which the median lobe and the vesical neck are chiefly concerned. In those of lateral hypertrophy, in which the urethra is simply narrowed, or is narrowed and rendered tortuous, it might be of use. If it is tried it should certainly be conducted under ether, and should be carried to the furthest degree consistent with safety. I have often thought of following the suggestion made by Physick, early in the century, as to the use of what he called "hydraulic compression," for which he invented a special instrument, or of repeating Sir Henry Thompson's experiments with a hydrostatic dilator which were made nearly forty years ago, but I have never done so.

Thompson dismissed the whole subject in his later publications with the remark that no one of experience now ventures to use instruments sufficiently large to produce any diminution of the gland or any dilatation of the canal which passes through it, by the agency of compression, on account of the probability of exciting prostato-cystitis. He rejects, too, the idea that by this agency any beneficial effect on the gland is possible. It must be remembered, however, that this opinion dates back to the time when antisepsis in genito-urinary surgery was unknown and unthought of. Undoubtedly this mode of treatment, with the slight bruising of the gland and the minute lacerations of the mucous membrane produced by it, favored the development of an infective inflammation, and this was probably the cause of the "aggravated suffering" which Thompson describes as following dilatation. I do not mean to deny the possibility of exciting a traumatic prostato-cystitis, but would regard that risk as one which might well be assumed by both patient and surgeon if the method lessened the obstruction, which is the chief cause of all the gravest symptoms. The atrophy of the prostate following stricture of the urethra is well known, and is asserted by Thompson himself to be due to pressure.[1] I have been led to bring this subject forward because my experience with the simpler dilatation by means of ordinary sounds, seems to me to justify hope of greater good from more thorough treatment conducted on the same lines. I have, however, included it among operative instead of palliative measures, because it is a more formal procedure and aims at further-reaching and more permanent results. A still more radical application of the same idea has been suggested by Bangs, viz., the dilatation of the prostate through a perineal incision. This also has not been tried in a sufficient number of cases to warrant a final opinion.

The theoretical advantage of a hydrostatic dilator would be the uniform pressure exerted on the whole circumference of the prostatic urethra and vesical neck, with less risk of dangerous laceration of the mucous membrane than by the metallic dilators.

The operation may be said to be indicated (tentatively or experimentally) in those cases in which palliative treatment has failed and more radical measures are declined.

(2) *Perineal Prostatotomy*, in the simplest form, as to the usefulness of which we have any satisfactory evidence, consists in

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[1] Loc. cit., p. 118.

opening the urethra at the apex of the prostate by a median perineal incision, and dividing the obstructing portion of the gland by means of a probe-pointed bistoury, cutting from within outward. The channel may be further enlarged by divulsion with the finger.

This operation, described by Harrison as a suggestion of Guthrie's, and as combining Cock's operation for opening the urethra with Mercier's for division of the "bar," is of little use unless the further suggestion of Harrison be also adopted, and prolonged drainage by means of a large-sized tube worn continuously for weeks be regarded as an essential factor of the procedure. Of eleven cases (Moullin's tables), in which this, or a closely similar method, including continuous drainage, was employed, six were "cured" and two "much improved."

The mortality from perineal prostatotomy, according to the same statistics, is 1 in 24 (4.5 per cent. approximately); and in the fatal case the patient, who was eighty years of age and in whom the bar at the neck of the bladder had been freely divided, died of uræmia.[1] The operation should be regarded as that of choice in all those cases in which with marked diminution of expulsive force and with cystitis there are also evidences of wide-spread degenerative changes or of distinct renal disease, and toxæmia and general feebleness are present. It is also to be preferred as a rule even in the absence of renal or constitutional symptoms if the bladder is rigid and contracted, and will hold only a few ounces of urine, or if the atony is nearly absolute and does not tend to improve under careful treatment.

The precise mode by which it acts has not been demonstrated, but it seems probable that it is a combination of mechanical dilatation of the channel with a certain amount of cicatricial contraction in the substance of the gland, reducing its bulk in the immediate vicinity of the urethra and thus diminishing its obstructive power.

(3) *Perineal Prostatectomy.*—As a more or less accidental accompaniment of lithotomy, projecting portions of the prostate being caught and extracted with the calculus, this operation has

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[1] Wishard, American Journal of the Medical Sciences, November, 1890.

been for years familiar to the profession. As a formal procedure it is more recent. Moullin's tables contain fourteen cases with two deaths, one failure and eleven "cures," a mortality of 14.3 per cent. The chief clinical indications for the operations may be said to be those already enumerated as justifying prostatotomy, which may always be converted into a prostatectomy if the perineal distance permits the growth to be reached by the finger and it is found to be of small size, and limited to the median line posteriorly, or pedunculated and acting like a ball-valve at the neck of the bladder.

The latter condition may be suspected if in an old man, without marked prostatic symptoms and with no calculus, sudden and complete retention comes on, and still more especially if there has been sudden stoppage of the stream during urination, and if in spite of these symptoms catheterism is not difficult.

The projecting portion may be seized by the finger or forceps, or caught with a wire, or with a galvanic ecraseur, and removed. The results, as above stated, have been remarkably good.

The chief objections to the method as a formal procedure, when a radical operation has been determined upon, are that in only about one-third or one-fourth of the cases (Watson, McGill) could the growth be reached by the finger of the operator; that often even when accessible to the finger it cannot be satisfactorily dealt with through the narrowed urethra; and that vesical projections are altogether beyond reach for accurate or careful manipulation.

(4) *Supra-pubic Prostatectomy* is the operation to be preferred in all those cases in which, palliative treatment having failed, there are unmistakable indications that the local conditions are growing worse, the general health remaining as yet unaffected.

The best possible period is that before the development of marked and continuous cystitis, while some power still remains in the vesical walls, and the bladder is neither thinned and dilated nor rigid and contracted.

Under these circumstances, in the presence of a patient who reports that he is disturbed at night with increasing frequency; that he is obliged to use the catheter oftener, and not only does so with greater discomfort, but with less relief in the interval; that the urine is occasionally turbid and offensive; that he has recently had one or more attacks of retention; and that he is beginning to lose flesh and appetite, it appears to me that the indications for operative interference are unmistakable, and that the supra-pubic method is obviously the one to be selected.

It permits in every such case a thorough manual and visual exploration of the bladder, and a digital exploration of the prostatic urethra, and is, therefore, if for no other reason, to be preferred to the perineal method. The difference in mortality, if we may venture to compare the last half of Moullin's table of supra-pubic prostatectomies (which comes nearest it in dates) with his table of perineal operations, is not a very serious one, showing for the supra-pubic operation seven deaths in forty-seven cases (operated on since June, 1889), a mortality of 14.9 per cent.; and for the perineal operation two deaths in fourteen cases (operated on with one exception since June, 1891), a mortality of 14.3 per cent. The difference in results cannot be numerically compared, but it may safely be asserted that it is altogether in favor of the supra-pubic method.

In a certain proportion of cases, as might be expected, the bladder does not recover its power, but this proportion in the series above mentioned was only about 20 per cent. It would certainly be still less if earlier operation were insisted upon. It must be understood that even when the loss of expulsive power continues there is often so much gain in the matter of comfort, in the lessening of the cystitis, in the facilitation of catheterism, etc., that the operation should be regarded as essentially a success, even although a complete cure has not been obtained.

Recurrence of the growth after the more radical operation has not happened with sufficient frequency to make it a matter of any practical importance, having been noted in less than 1 per cent. of the recorded cases.

Dittel's operation of lateral prostatectomy has been used by Kuster in three cases with a moderate degree of success. It seems applicable only to those patients in whom the obstruction depends upon enlargement of the lateral lobes, and in whom at the same time the small size of the bladder, and the rigidity of its walls prevent the supra-pubic operation.

In a number of cases (Schmidt, Guyon, McGill, Belfield), various forms of obstruction due to *sub-urethral* prostatic growth have been found, and have either rendered the supra-pubic operation a failure, or have required special operative measures for their relief. There seems no reason to question the propriety in every case of supra-pubic prostatectomy, of examining the prostatic urethra with the finger, and of performing perineal urethrotomy if a hard mass or a rigid ring is discovered (Belfield). This admits of thorough stretching, of incision, or of excision, and adds but little, if at all, to the dangers of the case.

As to the technique of the supra-pubic method, the adoption of Trendelenberg's position; the omission of the rectal bag; the arrest of hæmorrhage by an internal pad held in place by a string carried through a perineal incision (Keyes); and the use of an ecraseur introduced through the urethra, the mucous membrane over the growth being incised, and the wire being guided to its proper place through the usual supra-pubic incision, are the modifications most worthy of mention. The latter suggestion seems to me worthy of note as enabling us in desperate cases to reduce the hæmorrhage to a minimum, and to remove only that portion of the prostate which is really obstructive. I called attention some time ago[1] to the fact that the risk of hæmorrhage, of shock from prolongation of the operation, of sepsis from the exposure of a larger absorbent surface, are all directly increased with the amount of the prostatic overgrowth which is removed, making it most important that we should know how *little* we may do with a reasonable prospect of resulting benefit. In two of the three deaths set down by McGill as directly due to the operation, large portions of the prostate had been taken away, and I have had the same experience. That age, with its associated debility, is not the chief factor in causing death is shown by the fact that of ninety cases, in which the age is given Moullin), the average was sixty-four and one-half years, while of eighteen fatal cases the average was only sixty-six and one-half years. The difference is not great enough to warrant the assumption that age is of primary importance in determining the mortality. It must not be forgotten that the object of the operation is to restore a " low-level channel " through the prostate, and is not simply the excision of the overgrowth (Belfield). Moullin says that practically, if the operation is to prove successful, it resolves itself into removing the whole of the vesical mass, whether it springs from the lateral lobes, or is an upgrowth from the posterior wall, or is a detached nodule. This may be true, but it has certainly not yet been demonstrated. Every surgeon who has done a number of tonsillotomies is familiar with the remarkable diminution in size of that gland which may follow the removal of a comparatively trifling portion. It may be found that similar contraction of the prostate will result from the removal of merely the most salient portion. If so, it would undoubtedly lessen the mortality, and greatly promote the general acceptance of the operation. The lessening in the size of the prostate, which in a number of instances has followed Harrison's operation of puncture of the post-prostatic pouch with a trocar and canula, and to which I have already alluded, seems to have some bearing upon the question. In some of his cases after withdrawal of the tube normal micturition was re-established.

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[1] Medical News, December 13, 1890.

Two cases in my own experience (one of them not yet published) illustrate this point excellently. In one, a patient aged sixty-eight years, with complete loss of expulsive power for four years, with a violent cystitis, marked renal disease, a vesical calculus, a mitral murmur, and other evidences of degenerative changes, I was led by the enormous size of the intra-vesical growth to remove successive portions until I had taken away eight, varying in size from that of a hickory nut to that of a large walnut, and weighing altogether three ounces. The patient did well for three and a half days, then developed uræmic delirium, and died of suppression of urine on the seventh day.

The other case, a man of sixty-six years of age, was in much the same condition. He had passed no urine voluntarily for more than three years; he was using or attempting to use the catheter every half hour, was suffering intensely all the time and was rapidly emaciating. He also had intense cystitis, albumen and casts in the urine, pipe-stem radials, etc. The bladder was so thin that on attempting to make its wall prominent in the wound to facilitate incision, by means of a silver prostatic catheter, the point of the instrument perforated it, an accident I had never seen before.

In this case I contented myself with the removal of small portions of prostate immediately around and beneath the vesical orifice, freeing that completely, but paying no attention to the lateral lobes. The patient made an uncomplicated recovery, and is now using the catheter painlessly and never more than five times in the twenty-four hours. He sleeps six hours without awaking, and is markedly improved in general health. The enlargement in his case was not unlike that in the other, involving the whole gland and extending into the bladder.

The improvement is so disproportionate to the extent of my interference with the growth, that I am convinced it is partly due to subsequent contraction of the remaining portions of the gland. Of course in this case there has been no recovery of expulsive force, but I do not believe that any operation, however extensive, could have brought that about. The case has impressed me anew with the desirability of learning the minimum amount of interference which will be effective.

(5) I have one further thought which I have decided to mention to this association, although I do so with a reluctance born of the fear of being considered illogical or impractical, or perhaps both. It occurred to me some time ago that possibly, if the analogy between uterine fibro-myomata and prostatic overgrowth was a real one, castration might have the same effect upon the latter that oöphorectomy does upon the former, and cause a shrinkage or atrophy which would result in the practical

disappearance of the obstruction. At the time I had never heard or read of the alleged prostatic atrophy in eunuchs, geldings, etc., which I have already mentioned. While I was unaware that any allusion even had been made in medical literature to this subject, I instituted a series of experiments, which were carried on for me by Dr. E. R. Kirby, of the University of Pennsylvania, and the results of which are subjoined. The microscopic specimens are here for examination by the members of the association.

In the experimental work dogs were used partly for convenience, partly because it is known that in this animal the prostate occasionally undergoes changes similar to those which are found in the human prostate.

The literature was carefully looked up, and no reference as to the average or normal weight of the prostate in dogs could be found.

For control experiments thirty-five dogs and their prostates were weighed, and the average weight taken as a standard. The average weight of the prostate was found to be 15.3748 grammes. The relative weight of the prostate to the weight of the dog was also taken into consideration and is given in each case.

The dogs were castrated and killed at different intervals. The prostates were hardened in alcohol, cut by the freezing celloidin method, stained with borax carmine, and mounted in Canada balsam.

No. 19. Weight of dog 15 kilos. Average weight of prostate in dogs, weighing from 14 to 16 kilos inclusive, 15 grammes. Dog killed at the end of 17 days; weight of prostate 5.420 grammes. In this specimen the normal relation of the different structures seems to exist. No change noted.

No. 21. Weight of dog 14 kilos. Average weight of prostate in dogs weighing from 13 to 15 kilos inclusive, 13 grammes. Dog killed at the end of 21 days; weight of prostate 5.700 grammes. In this specimen beginning changes in the glandular structure are seen. The muscle fibres show but little change. From this it would seem probable that the glandular elements are the first to undergo atrophy.

No. 20. Weight of dog 14 kilos; 30 days; weight of prostate 2.600 grammes.

The glandular structure shows well the beginning atrophy. The glands are irregular in outline, smaller than normal and separated from each other by considerable connective tissue. Very few muscular fibres are to be seen.

No. 4. Weight of dog 20 kilos. Average weight of prostate in dogs weighing from 19 to 21 kilos inclusive, 19 grammes; 32 days; weight of prostate 2.620 grammes. The picture is here about the same as that seen in No. 21.

No. 16. Weight of dog 15 kilos. Average weight of prostate in dogs weighing from 14 to 16 kilos inclusive, 14 grammes; 41 days; weight of prostate 5.700. In this specimen the glandular elements are but slightly atrophied, especially in some places. Many muscular fibres can be seen, all, however, atrophied.

No. 13. Weight of dog 31 kilos. Average weight of dogs weighing from 29 kilos upward, 30 grammes; 54 days; weight of prostate 4.420 grammes. Atrophic changes well marked. The connective tissue elements predominating.

No. 14. Weight of dog 23 kilos. Average weight in dogs weighing from 22 to 24 kilos inclusive, 21 grammes; 54 days; weight of prostate 2.700 grammes. The glands show somewhat better in this specimen, but are widely separated from each other by bundles of connective fibres, and the longitudinal stripes are well marked.

No. 24. Weight of dog 15 kilos; 60 days; weight of prostate 1.500 grammes. Presents practically same picture as No. 13.

No. 9. Weight of dog 22 kilos. Average weight of prostate in dogs weighing from 21 to 23 kilos, 21 grammes; 61 days; weight of prostate 4.000 grammes. Here and there in this specimen may be seen masses of closely-packed cells, evidently the remains of the glands. Few muscular fibres can be made out. Longitudinal stripes well marked. No nuclei to be seen.

No. 8. Weight of dog 25 kilos. Average weight of prostate in dogs weighing from 21 to 29 kilos, 21 grammes; 65 days; weight of prostate 4.500 grammes. There is considerable atrophy of both the glandular and muscular elements, connective tissue predominating.

No. 5. Weight of dog 26 kilos; 72 days; weight of prostate 3.920 grammes. In this specimen but little of the glandular structure remains. What gland acini can be seen are very small and irregular in outline. There are but few muscular fibres to be seen, and their outline is not sharply defined. No nuclei can be seen.

These results, which I believe may be relied upon, place beyond all peradventure the influence of castration (in the dog at least) upon the condition of the prostate, and show clearly that that operation is followed invariably, and with a promptness which I must confess was to me surprising, by atrophy first of the glandular and then of the muscular elements, and by a coincident reduction in both bulk and weight. Since instituting them I have become familiar with Griffiths'[1] admirable papers, and have learned from them the following facts:

John Hunter observed that in the mole the prostate gland in winter was "hardly discernible, but in the spring becomes very large and filled with mucus."[2] Owen confirms this, and adds that "the prostate gland in the mole begins to increase in February and acquires an enormous size and conceals the urinary bladder toward the end of March." Owen found similar changes in the prostate of the hedgehog. Griffiths examined for himself the generative organs of the mole and the hedgehog in and out of the rutting season, and found the above observations to be correct. He made a number of sections of the gland in the quiescent state, and others during the period of sexual activity. During the former period he found it composed of a few tubules lined by flattened and small epithelial cells, undoubtedly functionless as regards the production of any secretion, but possessing the power of reproducing glandular epithelial cells at the appropriate period. Precisely similar phenomena were observed in the seminiferous tubules of the testicle, and in both the changes were preceded by an increased vascularity of the whole tract, determining an increased growth of all the glands and parts concerned in generation.

As to the effects of castration, Hunter[3] again was the first to note that while the prostate of the perfect bull is soft and bulky, that of the castrated animal is "small, flabby, tough and ligamentous."

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[1] Journal of Anatomy and Physiology, Vols. XXIII and XXIV.

[2] Works edited by Palmer, Vol. IV, p. 29.

[3] Works, Vol. IV, p. 30.

Griffiths contributes four observations of his own, two in the dog and two in the cat, the castration having been performed for other reasons years before, in all of which the prostate had been transformed into a mass of fibrous connective tissue containing the remains of the once active gland tubules with a small number of atrophied muscle fibres. He also examined the generative organs of the pig, bullock, sheep and horse after castration, and found that in each case like changes had supervened.

I learned further that Gruber[1] had observed marked atrophy of the prostate in a man of sixty-five who had been castrated in early youth; that Bilharz, in a thesis on "The Anatomy of the Genital Organs of Two Ethiopian Eunuchs"[2] confirmed Gruber's observations, and that Pelican,[3] in a book devoted to the study of a peculiar sect in Russia, says that the prostates in eunuchs are about the size of those found in children.

Furthermore, Civiale[4] has noted the fact that in doing a lithotomy on a man who had undergone complete castration for the cure of a double hernia, he found that the prostate had practically disappeared.

In a case of arrested growth of the external genitals, including the penis, scrotum, and testicles, so that in a man of thirty-three years of age they were only of the size of those of a boy of six or seven years, rectal examination showed that nothing more than a transverse ridge could be felt in the position of the prostate. Micturition was normal.[5] In cases of sterility in the male, it has been noted by Harrison that the prostate was atrophied.[6]

Let me now briefly marshal the facts which bear upon the affirmative side of this question.

The uterus and the prostatic vesicle originate from allied portions of the embryonic structures, the Müllerian ducts, and the uro-genital sinus, the glandular portion of the prostate itself springing from the mucous membrane of the latter.

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[1] Mutter's Archiv., 1847, S. 469.

[2] Berlin, 1859.

[3] Skopzenthum in Russland, 1875, S. 99.

[4] Traite practique sur la Mal. des Org. Gen. Urin., tom. II, p. 338.

[5] Griffiths, op. cit.

[6] International Encyclopædia of Surgery, Vol. VI, p. 388.

I am not arguing for absolute homology between the prostate as a whole and the uterus. This is denied by most modern authorities on apparently good embryological grounds. The important point to establish is that the prostate is essentially an appendage of the genital, and not of the urinary, apparatus, and this is certainly demonstrated by its origin, its absence in the female, the facts of comparative anatomy, and the observations above quoted.

As to its gross anatomy and pathology, it is made up largely of the same tissue as the uterus, and is subject to the same varieties of morbid growths occurring at parallel periods in the life of the individual.

The uterine tumors do not appear after the menopause, or if present already undergo atrophy. After a certain period of life there is no increase in the tendency to enlargement of the prostate, but rather the reverse.[1]

In the female, oöphorectomy causes a disappearance of these growths, and an atrophy of the uterus itself. Castration almost certainly has the same effect upon the normal prostate in our species, and I have experimentally demonstrated that it has such an effect in dogs.

It remains to ask:

(1) Does this evidence warrant us in believing that castration in cases of hypertrophied prostate would be followed by a disappearance or diminution of the growth?

(2) If so, is it likely that the fact can ever be taken advantage of as a therapeutic measure?

In answer to the first question, it may be said that one important piece of evidence is lacking, the absence of which renders incomplete the parallelism between the uterine and prostatic growths.

We have no recorded instances of the spontaneous shrinking of an hypertrophied prostate after the patient has reached a certain age.

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[1] Desnos. Dict. des Sct. Med. 2 Series, tom. XXVII, p. 506.

In reply, however, it may be stated that there is no definite or fixed period in the male at which the sexual life culminates and begins to wane, and after which procreation becomes impossible; and, further, that we have no knowledge whatever of the relation of cases of prostatic enlargement to the sexual function. That it may cause erythism, or unnatural sexual excitability, on the one hand, or may be associated with a form of impotence or of sterility on the other, is of course recognized; but the true relation of the growth to the period of functional activity, the secretory life of the testicles, is absolutely and entirely unknown.

Moreover, what may be called the accidental concomitants of the condition—accidental in the sense of being due to anatomical propinquity—the vesical and renal changes, usually cause death in the very cases which might otherwise demonstrate the truth of the theory, those subjects whose advanced years might of themselves through sexual failure prove curative.

An examination of Messer's tables, founded on a dissection of 100 prostates in men over sixty years of age,[1] discloses one interesting fact in this connection. Assuming arbitrarily that eighty may be taken as the age at which, in the great majority of men, the sexual life is absolutely and finally ended, we find that among those subjects whose prostates weighed over 6 drachms, the percentage of octogenarians or their elders was only 22.8, while among those whose prostates weighed less than 6 drachms many of them less than normal), the percentage was 35.3, more than half again as great.

This is not only confirmatory of Desnos' observations, already mentioned, that after a certain period in life the frequency of notable hypertrophy diminishes, but it suggests the possibility that in many of these cases physiological atrophy had already begun. The subjects were not selected from among patients, but just as they happened to come within reach of the investigator.

The uncertainty as to the exact duration of sexual life in the male also weakens the force of the statement that the condition does not manifest itself until after the period of life when it should occur if it were truly homologous with the uterine growth. In addition, it may be said that there is accumulating evidence that prostatic hypertrophy begins much more frequently than was formerly supposed during middle life, and that the statistics on which we have been accustomed to rely, based on museum specimens and on the experience of surgeons to whom the patients apply only when distinct subjective symptoms have developed, are to an extent unreliable.

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[1] Med. Chir. Trans., Vol. XLIII, p. 147.

I do not desire to be understood as insisting upon the truth or even upon the probability of the above hypothesis. I have simply, with much hesitation, determined to follow out publicly a line of thought that had occupied my mind at odd times, and to submit it to your criticism.

As to the second question, the possibility of employing castration as a therapeutic method in prostatic hypertrophy, I imagine that the final answer must be left to our patients.

Of one thing I am convinced, however, that if we ever reach a point in certainty of knowledge in this direction comparable to that already attained in regard to oöphorectomy in relation to uterine fibroids, and can promise equivalent results, there will be no lack of cases willing to submit to an operation almost painless, with a low mortality, and followed by no such unpleasant conditions as accompany persistent fistulous tracts, either suprapubic or perineal, even although the operation carries with it the certainty of sacrificing whatever sexual power has survived the excessive and often intolerable sufferings of such patients.

I might admit finally that I have not had the courage of my convictions, and have never seriously sought to recommend the operation, but it would be truer to say that I have as yet no definite convictions, and that I am simply seeking enough light upon the subject to convince me either that it is worth pursuing further, or, on the other hand, that it offers no possibility of practical usefulness.